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SOME SPECIES OF ARTHROPODS IN HIVES OF *APIS MELLIFERA INTERMISSA* (VON BUTTEL-REEPEN, 1906) (HYMENOPTERA, APIDAE) IN THE MITIDJA (ALGERIA)

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ABSTRACT

Other than bees, the hive is a refuge and laying medium for many animal species. In the central region of the Mitidja and in the *Apis mellifera intermissa* Von Buttel-Reepen, 1906 hive, 25 Artropoda species are collected. The Insecta dominated with 21 species, followed by Arachnida with 3 species. Among the Arachnida, the *Varroa destructor* Anderson et Trueman, 2000 is the most dangerous, the annual activity of this parasite in Mitidja showed a high rate of mites in april with an average of 10,008.8 individuals. Among the Insecta, 2 moths species are classified as dangerous: *Galleria mellonella* Linnaeus, 1758 and *Achroia grisella* Fabricius, 1794. This study also allowed us to select 3 species of Arthropoda that have a particular interest to fight against these parasites: *Apanteles galleriae* Wilkinson, 1932 with an average rate of parasitism on *A. grisella* equal to 81.1%, *Crematogaster scutellaris* Olivier, 1792 with a predation rate on *G. mellonella* and *A. grisella* equal to 100% and *finally Neobisiummuscorum* Leach, 1817.

KEYWORDS: Mitidja, Bees, Arthropoda, Varroa Destructor, Galleria Mellonella, Achroia Grisella, Apanteles Galleriae

INTRODUCTION

The invertebrate populations are often studied in different environments such as forests, orchards or herbaceous habitats. See the works of Orgeas and Ponel 2001, Holland and Reynolds 2003, Missa et *al*. 2009 and Obrist, M. K. and Duelli2010. In the case of, the hive, it can be an environment of refuge and nesting for many animal species, since it provides an ideal microclimate offering a constant humidity and temperature which may favour the establishment of fauna. Aside from parasites such as the *Varroa destructor* or wax moths (Imdorf et *al*. 2003. Belaid and Doumandji 2010; Neumann and Carreck. 2010, BensghirSemmar and Doaudi Hacini 2011, Vidal-Naquet, 2011, Adam, 2012 and Adjlane and *al*. 2012). That are the subject of much research, Arthropods living in hives are rarely studied. Therefore, the idea of the study was why not identify in these hives arthropods that can help the bees get rid of these parasites?What's more, this work would allow us to enrich the faunal list of arthropod species living in North Africa, particularly in Algeria.

MATERIALS AND METHODS

The experiment is carried out in the central region of Mitidja (2 ° 43 '3 ° 09' E, 36 ° 28 'to 36 ° 40' N). The average temperatures range between 10 ° C in winter and 27 ° C in summer. The annual rainfall averages between 600 and 700 millimeters. Mitidja is in a bioclimatic sub-humid floor with mild winter. The flora is very diverse. The landscape of the plain is a set of plots occupied some by citrus orchards (Aurantiaceae), apple or medlar (Rosaceae) and others by vegetable crops (tomatos, potatos, cabbages, carrots). Weeds belong to the Poaceae category including, Fabaceae, the Euphorbiaceae, the Boraginaceae, the Apiaceae, and Urticaceae to Oxalidaceae.

The harvest of Arthropoda is carried out on ten hives of the langstroth kind. Each hive is equipped with a wire millimeter mesh tray on which cardboard leaves are inserted. The samples obtained are identifed in the laboratory by means of dichotomous keys and books (Perrier, 1985; Grassée, 1951) A further confirmation of the arthropods identification is done by the entomologist SaleheddineDoumandji. Various debris from the trays are placed under observation in boxes 30 centimeters long and 20 centimeters wide, at ambient conditions (Temperature = 22 ° C ± 1 ° C, Relative humidity = 70%).

This same technique is used for estimating the population of *Varroa destructor*. Regarding the calculation of the average daily mortality of *Varroa destructor*, the number of *Varroa destructor* collected on cardboard leaves is counted on a daily average as follows: D.M. = N1 / N2

D.M: Daily mortality; N1: Number of dead mites, N2: Number of harvest days

For the calculation of the total number of varroa in the hive, Dr. Liebig method is used. The number of dark and light mites is counted. The daily result is multiplied by the factor 120. This calculation gives the total number of varroa in honey bee colony with an approximation of 300 individuals. This formula is used by the beekeeping federation of Bavaria (Pfeffere, 1983). The collection of arthropods is supplemented by hand harvest of all species identified.

RESULTS

List of Arthropoda Captured in Hives in the Plain of the Mitidja

Species of arthropods captured in hives are noted in Table 1.

Table 1: Arthropoda Species Seen in the Hives

Order	Species
Mesostigmata	*Varroa destructor*
	*Typhlodromus*sp.
Pseudoscorpionida	*Neobisiummuscorum*
Hymenoptera	*Vespulagermanica*
	Apanteles galleriae
	Tapinomanegerrimum
	Tetramoriumbiskrensis
	Monomoriumandrei
	Messorbarbarus
	Plagiolepisbarbaraschmitzi
	Crematogaster scutellaris
	Camponotusbarbaracusxantomelas
	Chalcidae
Coleoptera	*Oryzaephilussurinamensis*
	*Cryptophagus*sp.
	Staphylinidae
	Cetoniafloralis
Heteroptera	*Parmenabalteus*
	Cardiastethusnazarenus
	*Aphainus*sp.
Homoptera	Tonoceridae
Dermaptera	*Forficula auricularia*
Lepidoptera	*Achroia grisella*
	Galleriae mellonella
Myriapoda	*Julus*sp

A total variety of 25 species was observed in the hives of the central region of Mitidja. The Insecta dominated with 21 species followed by the Arachnida (3 species) and finally the Myriapoda with 1 species (*Julus*sp.).

Main Parasite Species Collected in Hives: *Varroa Destructor, Galleria Mellonella* and *Achroia Grisella*

The species of this group are the most harmful towards bees. They are the main source of viruses and bacteria causing diseases.

***Varroa Destructor* (Anderson and Trueman, 2000)**

V. destructor mites are parasites of adult bees and brood. Visible to the naked eye, the female is elliptical, and of brown coloration, the male is more yellowish and smaller. Only females are infectious, they fit between the abdominal segments of adult bees where they perforate the intersegmental membrane in order to ingest the hemolymph. They can be also being found between the head and thorax.

Activity of *Varroa Destructor* in the Hive

The activity of *V. destructor* is followed for one year in 9 hives in the central region of Mitidja, seen figure 1.

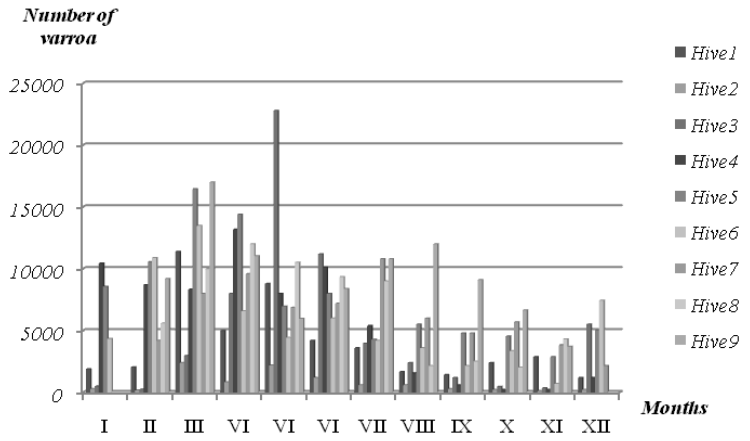

Figure 1: Variations in the Number of *Varroa Destructor* Depending on the Months

The population of *V.destructor* begins to increase from February peaking in april with an average of 10008.8 mites per hive. But as soon as May the population of the *Varroa destructor* begins to decrease, up to 2120 mites in december.

***Achroia Grisella* and *Galleria Mellonella* (Pyralidae)**

Two species of moths of the family Pyralidae are observed in the central part of the Mitidja. One is the small wax moth (*Achroia grisella*Fabricius, 1794) and the other is great wax moth (*Galleria mellonella* Linnaeus, 1758). In Mitija, *A. grisella* caterpillars are present throughout the year. This can be explained by the mild Mediterranean climate. Cocoons containing live *G. mellonella* caterpillars are collected in a hive in January despite much cooler days (average temperature = 6 ° C.).

Main Commensal Species of Bees Collected in the Hives

Among the commensal species of honeybee collected in the hives, three of them show a particular importance in the biological control of the enemies of the bee.

***Apanteles Galleriae* (Braconidae, Microgasterinae)**

Apanteles galleriae Wilkinson, 1932 is a solitary endoparasite species of *G. melonella* and *A. grisella*.

***Apanteles Galleriae*'s Activity in the Hive**

The parasitic activity of *A. Galleriae* in vitro at medium temperature 22 ± 1 ° C and relative humidity of 70% on *A. grisella* represents a very high rate of parasitism, 89.6% in the first batch in which 87 out of 97 caterpillars examined are parasitized. In a second batch of 73 baring the same conditions of temperature and humidity, the rate of parasitism is 72.6%. These percentages show the importance of the action of the parasitoid in the control of wax moth population.

***Crematogaster Scutellaris* Olivier, 1792 (Formicidae, Myrmicinae)**

Of the 7 species of ants found in hives, *Crematogaster scutellaris* (Olivier), attracts attention by its predatory activity against caterpillars *G. mellonella* and *A. grisella*. In one of the hives, 11 moths of *G. mellonella* and 20 moths of *A. grisella* appeared. The *C. scutellaris* ants attack the eggs laid by these moths and early stages caterpillars. Caterpillars who escape the ants are subsequently destroyed at a later stage. Out of a total of 89 cocoons of *G. mellonella*, 63 are completely emptied, the 26 caterpillars that have not yet undergone the last stage of transformation, are eaten in turn, once the state of pupae.

***Neobisiummuscorum* (Leach, 1817)**

This kind of speudoscorpion is collected twice in the hives (2 individuals). Its presence may be due to chance. However, several species of arthropods ambush on flowers and await the arrival of nectar flower-feeding insects to cling to their ventral bristles and be transported by them. This is the case of triongulin, Meloidae larva which attaches to a honeybee or the case of the pseudoscorpion transported by flies like Lucilia, Sarcophaga and Calliphora. It is very likely that the *Neobisiummuscorum* (Leach) took advantage of a bee to bring it into the hive.

DISCUSSIONS

Cagniant (1973) admits that the presence of an animal in a given location is not by chance, but it establishes itself where it feels the best. Indeed, in addition to the thermal and moisture stability offered by hives, honey reserves, pollen and wax attract many animal species in search of food or just a shelter. Among the Insecta, the Hymenoptera are the most abundant with ten species of which seven are the Formicidae species. These results are not accidental as ants are very fond of honey and are sedentary species which have the advantage of being abundant (Cagniant, 1973). Chapleau (2003) estimated that when over 4200 mites, the population of *V. destructor* is considered important and the damages are clearly visible. In central Mitidja, this threshold is significantly exceeded; the increase of *V. destructor* coincides with increasing brood (OIE, 1995). The other reason for this increase is the presence of male broods in this period and the *V. destructor* prefers these (Donze, 1995 and Haubruge et *al*. 2006). Duy et *al*., (2003) estimate that one cell of male can count from one to five females *V. destructor*. In Mediterranean climate Branco et *al*., (1999) suggest that the population *V. destructor* rise exponentially throughout the period from May to November with the number of females going from 32 mites to 6246 mites which is explained by the continued presence of brood. According to Kraus and Page (1995), the rapid growth of the parasite in the Mediterranean climate is not due to a higher rate of reproduction, but to the continuous ability to reproduce in the brood present almost throughout the year.

Achroia grisella and *Galleria mellonella* attack honeycomb on which they feed. Wax moth larvae bore into the frames of brood and pollen which they destroy rapidly (Adam, 2008). Of these two species, *G. mellonella* is the most dangerous, considering that the caterpillars born from 500 to 1800 eggs of a single female, can consume 750 grams of wax, not to mention the damage done to the shelves soiled with faeces and pierced through the galleries (Euverte and Martouret, 1963). The small wax moth can live from organic rejects accumulated either in or near the hive of bee colonies (Greenfield and Coffelt, 1983). *A. galleriae* is a lonely Microgastrinae parasite of *G. mellonella* and *A. grisella*, where only one larva develops per host (Ibrahim, 1980). According Uçkan and Gülel (2002), the total average number of offspring produced by a single female is about 232.6 on *G. mellonella* and 229.7 on *A. grisella*. According to He et *al*. (2009), *A. Galleria* can parasitize from the first to fourth caterpillar stage *G. mellonella*. The Bionomics and reproductive potential of *A. galleria* can be affected by the host caterpillar's food (Abo Abdala, 2006), the adult size also varies depending on the host (Uçkan and Gülel, 2000). In the hive, ants are opportunist and fond of honey, they can also attack the larvae and pupae but the damage is rarely significant (Adam, 2012). According to Bertrand (1972), the ants do not venture inside the hive, they settle under cover for nesting or in the angles outside partitions, beinattracte more by the heat and a good shelter. *C. scutellaris* is a common arboreal ant which frequent hives. The collective foraging technique used by their workers allows them to capture and bring back to the nest preys up to five times larger than them (Richard et *al*., 2001). *C. scutellaris* have shown a large predatory activity towards the larvae of *G. mellonella* and *A. grisella*. Among Nearly 300 species of pseudoscorpions scattered across the globe, a dozen species have been living in hives (Donovan and Paul, 2005, Donovan and Paul, 2006). According to Donovan et *al*., (2006), these arachnids mingle with bees and can climb on them thus moving when swarming. According to the same author, the pseudoscorpions collected in Asian bee colonies in India were photographed devouring enemies arthropods of bees such as bees wax moth and *V. destructor*. Hives containing Pseudoscorpions contain few varroa and no moth caterpillar (Sudarsanam and murthy, 1990), in the same line, extensive research on the diet of pseudoscorpions have proven that they did not cause damage to the larvae and bees.

CONCLUSIONS

According to these results, we conclude that other species coexist with bees. As well as natural environment, a biological balance can be installed in the colonies, for the proper functioning of the hive.

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